

### **ABSTRACT**

Various modifications to conventional information coding schemes that result in an improvement in one or more performance measures for a given coding scheme. Some examples are directed to improved decoding techniques for linear block codes, such as 5 low-density parity-check (LDPC) codes. In one example, modifications to a conventional belief-propagation (BP) decoding algorithm for LDPC codes significantly improve the performance of the decoding algorithm so as to more closely approximate that of the theoretically optimal maximum-likelihood (ML) decoding scheme. BP decoder performance generally is improved for lower code block lengths, and significant error 10 floor reduction or elimination may be achieved for higher code block lengths. In one aspect, significantly improved performance of a modified BP algorithm is achieved while at the same time essentially maintaining the benefits of relative computational simplicity and execution speed of a conventional BP algorithm as compared to an ML decoding scheme. In another aspect, modifications for improving the performance of conventional 15 BP decoders are universally applicable to "off the shelf" LDPC encoder/decoder pairs. Furthermore, the concepts underlying the various methods and apparatus disclosed herein may be more generally applied to various decoding schemes involving iterative decoding algorithms and message-passing on graphs, as well as coding schemes other than LDPC codes to similarly improve their performance. Exemplary applications for improved 20 coding schemes include wireless (mobile) networks, satellite communication systems, optical communication systems, and data recording and storage systems (e.g., CDs, DVDs, hard drives, etc.).